



Data Viewer

Student Training

Focus: Conservation/Recreation...Trails

State Perspective

Lesson #4

Introduction

Social Studies Mathematics Language Arts Science

“Long Distance State Trails –Where should we begin Maintenance?”

Background: Many “long distance trails” exist throughout Massachusetts. The Department of Environmental Management (DEM) manages most of the trails. A challenging task, is the continuous maintenance of the trails due the need for removal of fallen trees, washed away trails, erosion, and human impacts. Another concern is that the use of the trail or maintenance on the trails not negatively impact sensitive wildlife habitat areas. The Natural Heritage Data for Massachusetts maintains data bases that includes information about non-game species throughout the state. Of special interest are species that are threatened, the location of vernal pools, rare habitats, and priority sites for various kinds of habitat protection. We will use the MassGIS Data Viewer to examine the location of various long distance trails in the state, to see their relationship to areas of high species density, and to determine which trails are the easiest to begin a maintenance project during the summer. We will begin by looking at the trails and Natural Heritage data from a statewide perspective.

Problem: You have been contacted by state officials to act as a “student trail advisor” for your area in Massachusetts. A major concern facing staff in the Department of Environmental Management is that the state needs to continuously repair and maintain the long distance trails throughout the state. The most efficient way to maintain the trails is by hiring high school students for summer employment. During the late winter, early spring, the DEM begins planning its summer maintenance schedule. The DEM has asked high school students throughout the state, to examine the existing trail systems using the MassGIS data, and to recommend one or more trails for maintenance in their area. Once some trails are selected, high school students in the abutting communities will be contacted through their guidance departments asking for student workers. Your job is to examine the trail data, and use the following criteria for recommending which trails should be used in the summer maintenance/repair program. The criteria for trail selection are:

- Trails areas proposed for maintenance must be located in areas having a low species density factor as defined by the Natural Heritage Association.

- Communities that are traversed by the trail must be identified so that high schools can be contacted to begin the student application process for summer employment.
- DEM regions must be identified for each trail system and these regional offices will serve as the headquarters for summer maintenance work.

Your Task: Use the MassGIS Data Viewer to gather your information concerning Long Distance Trails, Communities where they are located and trails that may have high species density according to Natural Heritage data. From your information and Viewer observations, you are to answer basic questions from the DEM, complete a Data Sheet based on your Viewer observations, and make a written recommendation for a trail in your area where you believe a summer maintenance program should begin.

DEM Questions:

1. List the names of the long distance trails in Massachusetts.
2. In what general parts of the state are the long distance trails located.
3. In the process of maintaining existing trails, are there any areas where the trails pass through areas identified as having high species density?
4. Do any of the existing trail systems in Massachusetts connect the state with other New England states?

Mass Data Viewer Skills:

- *Adding Feature Themes to a View*
- *Setting View Properties (Map Units, Distance Units)*
- *Working with Tables (Sort Ascending, Sort Descending, Query, Summarize)*
- *Legend Editor (Symbol Changes: Fill Palette, Color Palette, Pen Palette)*
- *Labeling Theme Features (Auto Label, Text Label)*
- *Spatial Analyst (Theme on Theme)*

Viewer Buttons and Tools:

- *Find Button*
- *Select None Button*
- *Open Them Table Button*
- *Measure Tool*
- *Pan Tool*
- *Label Tool*
- *Promote Button*



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Data Viewer Skills

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“Long Distance State Trails –Where should we begin Maintenance?”

Creating a Long Distance Trail View

1. Beginning the Viewer:

- a. Open the MassGIS Data Viewer so the Viewer window contains the theme “MA Towns”. Maximize the “View” window.

2. Adding Themes:

- a. Under the Conservation/Recreation menu, Trails menu add the theme “Long Distance Trails”.
 - b. Under the Conservation/Recreation menu, Natural Heritage Data menu, add the theme “Species Density”.
 - c. Under the Political Boundaries menu, New England States menu, add the “New England States..Outline” theme.
 - d. Under the Political Boundaries menu, DEM Regions menu, add the “DEM Regions” theme.
 - e. Turn on the “Long Distance Trails”(LDT), the “Species Density”and MA Towns themes.
 - f. Make the “Long Distance Trails” theme active.
- Dilemma:** We must make the long distance trails more visible. The light colored lines do not show up clearly, and they are too thin.

3. Using the Legend Editor (Changing Symbol Colors, Making Lines Thicker):

- a. Double click in the “LDT” block in the Table of Contents.
- b. In the “Legend Editor” under “Color Schemes”, select “The High Seas”. Click Apply.
- c. Under the symbol column in the “Legend Editor” window, select the “line” by double clicking on the line symbol.
- d. In the “Pen Palette”, change the line size to 2. Repeat this process for all 8 trails. When finished click Apply. Close the “Legend Editor”.

4. Using Label Tools and Buttons (Naming Trails)

- a. With the LDT theme activated, select “Auto Label” from the Theme menu. Be sure the “Label Field” is “name”. Click OK
- b. When this operation is completed, you will notice that most of the trails are labeled, but some are not. Use the “Label Tool” (Call Out) to label any trails not identified when you used the “Auto Label”.

Hint: The “Label Tool” menu pulls down. Select the “Call Out” label. Move to your View, and click onto the trail not named. Holding your mouse down, draw a small distance from the trail. A label with a “call out” tag will appear next to the trail.

5. Using the Table of Contents to Work with Other Themes

- a. With the “species density” theme turned on, notice which colors represent the highest density. Species density is given in the number of species per square mile. We do not know if the data represents the same species or different species.

- b. Make the “LDT” theme visible over the “Species Density” theme.

Hint: Using your mouse, move the LDT theme so it is at the top of your Table of Contents, and Species Density theme below it, and the MA Towns theme last. Any other themes should be below the MA Towns theme.

- c. Examine the trails throughout the state. *(1) Based on your first observations, which trail seems to have mostly communities with low or no species density?* (Data Sheet)

6. Using Table Information (Sort Ascending, Sort Descending)

- a. Make the Species Density theme active. Open the Species Density theme table.
Hint: go to the theme menu and select open table, or use the open table button.
- b. Examine the various fields in the table. Find the field that represents species density. Click on the species density field and then click the “Sort Ascending” button. All items in this field are now arranged from lowest density to highest density. **(2) Examine the table and find five communities that have the lower densities and five that have the higher densities.** (Data Sheet)
- c. Return to the species density field, select it again, but this time click the “Sort Descending” button. Notice how the field arrangement has changed. It should appear from highest density to lowest density in your chart. Close the table and return to your View

7. Using the Find Button To Find Your Community

- a. Make the MA Towns theme active. Using the Find Button locate your community in the View.
Hint: Click on the “Find Button” and type in your community’s name.
Click OK. Your community should appear a selected yellow color in your view.
- b. If your community is not yellow, it is probably because the MA Towns theme is “transparent”. Go to the theme menu, and open the Table for the MA Towns theme. Click on the “Promote Button” to bring the “selected” community to the top of the Table. It should be your community, shown in yellow. Minimize the Table, but do not close it.

8. Using the Legend Editor to remove Transparency

- a. In order to see your “selected” community in the view, we need to make the MA Towns theme have a color rather than being transparent. Double click on the MA Towns theme in the table of contents. When the Legend Editor window opens, click on the “Symbol”.
- b. In the “Fill Palette” you should see a small square drawn around the solid white square in the palette. With your mouse, click on the black square next to it. This will make your MA Towns theme show color. (This means the fill is not transparent but will appear with a solid fill.)
- c. But we need a color that is light enough for us to see the Long Distance Trails theme overlaid on the MA Towns theme. With the mouse, click on the “Color Palette” (Paint Brush icon). Select a color such as light pink. Click apply and close the Legend Editor Windows.

- d. Your MA Towns theme should appear pink in your View, and your community should appear yellow because you selected it skill #7 above. If it does not appear yellow, be sure to turn off the “species density” theme.

Hint: If this theme is located above the MA Towns themes in the Table of Contents, it will cover your community shape.

9. Using the Table Query Tool to Find Your Community

- a. Another way to find your community in the View is to do a query of the Table data.
- b. Make the MA Towns theme active. Go to the “Edit menu” and click on the “Select None”. This will remove the yellow from you community selected in Skill #7. Click on the query button, or go to the Theme menu and select “Query”.
- c. Queries are ways of finding out information by building sentences. The trick is forming the correct sentence by double and single clicking, and also using the correct words and symbols.

Hint: If the wrong words or symbols are used, or some words or symbols are missing, when you click OK, the computer will tell you “syntax error”. So be careful.

- d. In the Query window double click on the “town”. Then single click the equal symbol. Then double click on your town’s name.

Hint: You will need to scroll through the list of community names. When you find yours, double click it.

- e. Now click “New Set”. If all is done correctly the Viewer will find your community’s record in the Table. If you get a “syntax error” check to be sure you have all the punctuation correct. If there are problems repeat the procedure described previously. Close the query window.
- f. When the Query is done, return to your table. Use the “Promote button” to bring the selected record to the top of the Table. Your community’s record should appear in yellow and be at the top of the Table.
- g. Go to the Window menu and select MassGIS Data Viewer. You should see your community in yellow on the map of Massachusetts.

10. Setting the View Properties to Enable Measuring

- a. In order to use the Measure Tool, you must first set the “distance properties” of the View. Go to the View menu and select “properties”. You will notice two boxes. One is printed “map units”, and other printed “distance units”. The map units must always be set to whatever measurement and projection standard your

- state data is using. In Massachusetts, the state gisdata is always Nad87 and in meters. Always keep the “map units” set to meters.
- b. The “distance units” may be set to whatever you want your tool to calculate and show. The distance units represent the measurement on the ground, and the map units represent the distance on the screen. If you prefer the distance units can be stated in meters, kilometers, or even miles. For our purposes, make the “distance units” miles.

11. Using the Measure Tool to Determine Length of Trails; Adjusting your View Screen with the Pan Tool.

- a. Use the “Pan Tool” to bring the state into the center of your View window.
- b. Examine the View of Massachusetts, and find your community in its “selected” yellow color. *(3) As you look at the map, try to determine by observation which trail is closest to your community and which is farthest away.* (Data Sheet)
- c. With your mouse, click onto the “Measure Tool”. Place your mouse over the middle of any trail, and click once. Now with the mouse drag the Measure Tool line to the center of your community. Click once, and do not move the mouse. Look at the lower Left corner of your view window. You should see a measurement in miles. This is the approximate distance from a point in the trail to the center of your community.
- d. Using the “measure tool”, *(4) find the trail that is the greatest distance from the center of your community, and the trail that is the closest to the center of your community.* (Data Sheet).
- Hint:** By doubling clicking the measure tool, you can disconnect it.
- e. Lets assume that the state is considering beginning its maintenance work on the Midstate Trail. *(5) Using the measure tool, determine the distance in miles of the Trail from its Northern to Southern border.* (Data Sheet)

Hint: Using the measure tool is a skill. Move it in short clicks. Move in short clicks and change direction, clicking only once each time you change direction. This may take practice.

12. Using the Table Fields and the Measure Tool to Verify your Measure Tool Skills

- a. Lets assume that you are concerned that the measure tool may not be very accurate or that your skill is shaky. We will use the measure tool to determine how close it is to the data supplied in the Long Distance Trails Table.

- b. Make the Long Distance Trails theme active. Because the length of the trails is reported in meters, we will need to return to the View properties. See step #10 above for a hint. Make the “distance units” meters.
- c. Return to the View. Be sure your cursor is a pointer and then select the “measure tool”. With the measure tool, carefully measure the distance of the Mid State Trail.

Hint: Remember to click on the measure tool. Move to your view, and locate the cursor at the beginning of the Mid State Trail and click once.

Carefully move the cursor to the next turn in the Trail, click once, continue this process until the entire trail is measured. **(6) When you reach the end, read and record the meters at the bottom of your View screen.** (Data Sheet)

- d. Double clicking the cursor while it is in the “measure tool” will cancel the line. Remove the line from the Midstate Trail.
- e. Return to the Long Distance Trails Table. Highlight the field with the trail name, and select ascending. Scroll to the list for the Midstate Trail. With a calculator, add up the meter lengths listed for the Midstate Trail. **(7) How does this agree with your measure tool findings?** (Data Sheet)

13. Using the Summarize Button with Tables (Eliminating Calculators)

- a. Adding up the various lengths in the Long Distance Trails table is tedious. Other methods exist for calculating total length. In the regular ArcView Software, many tools and methods are available for calculating, but in the Runtime Version of the MassGIS Data Viewer, we are limited.
- b. In our case, we will use the “Summarize” button. This is somewhat tricky so follow these directions carefully. Make sure that the Long Distance Trails theme is active, and open its Table.
- c. In the Table, highlight the field that provides the name of the Trail “Name”. With the mouse, click on the summarize button.
- d. A “Summary Table Definition” window opens. Ignore the “Save As” box. Because we are using the Runtime Version, we cannot save. In the “Field” box, type select Length. (This was the field in the Long Distance Trails table that contained the information on the length of the trail segments.) In the “Summarize By” box, select “sum”. This operation will add up all of the trail segments, and create a new table that shows us the total length of each of the trails listed in the Table.
- e. Click on the “Add” label. In the larger box, we should see “Sum_length” printed. Now click OK.

- f. A new table appears, that summarizes the total length of all the trails. Examine the new table, and see how it compares to your “measure tool” method, and your “calculation of the trail segments” for the Midstate Trail. ***(8) Based on this information, what would you say regarding the accuracy of the measurement tool, and its limitations?*** (Data Sheet)

14. Using More Themes from the Viewer “A Button” Menu: Political Boundaries

- a. Some of the Long Distance Trails actually cross into or come from other states. With the “New England States” theme turned on, ***(9) tell which trails seem to appear as “interstate” trails.*** (Data Sheet)
- b. Also notice if you see any trails that are restricted to just the state of Massachusetts.
- c. Turn on the DEM theme, and arrange the theme in the Table of contents so you can see your community.

Hint: You may have to make the MA Towns theme symbol Transparent.

- (10) Where is the DEM regional office located for your community?*** (Data Sheet)

- d. ***(11) If the Midstate Trail were selected for maintenance work, which DEM regional office would need to be contacted?*** (Data Sheet)

15. Using Themes to Analyze Spatial Relationships.

- a. One of the strengths of GIS Technology is its ability to examine several themes at once and look for relationships. Lets assume we wish to produce information in our View that clearly shows the communities where the Midstate Trail crosses.
- b. In this case we will be working with two kinds of vector data (polygons and lines). The communities are represented by polygons. The trails are represented by lines. First make the “Long Distance Trail” theme active. Us the “Query Tool” to select the “Midstate” trail. Make the MA Towns theme active. Turn off the New England States and the DEM Regions themes. The MA Towns theme is our “target theme”. We are interested in finding which towns are intersected by the Midstate Trail.
- c. Go to the theme menu, and select “Select by Theme”. In the “Select By Theme” window, in the first box, select “intersect”. In the second box, select “Long Distance Trails”. Select “New Set”.

- d. What now happens is that the Viewer moves through the tables of both the “Long Distance Trails” and “MA Towns” theme looking for those towns where the Mid state Trails travels through them. It will select all these communities and show them as yellow.

Hint: Remember to return the MA Towns theme back to a pink color and not transparent, if we expect to see the selected communities in yellow.

- e. Now return to the MA Towns theme table, and notice which communities are selected in yellow. Use the Promote Button to bring these to the top of the Table.
(12) List the communities that will need to be contacted by the Regional DEM if maintenance work is proposed on the Midstate Trail. (Data Sheet)

16. Using the Query Tool to find the trails with high to highest species density.

- a. One bit of information you must find is which communities have the high species density identified by the Natural Heritage. To do this you will need to do a Query. Go to the “Edit” menu and select “Select None”. (This clears all previously selected items so we can work freely without interference between themes.)
- b. Return to the View Window. Make the “Species Density” theme active. Look at the “Species Density” theme as it appears in your View. Be sure you can see the Species Density theme.

Hint: You may have to move your theme layers within the Table of Contents.

- Notice the Species Density theme is divided into four categories. The higher species density involves the darker colors. Notice the numbers given next to these colors in the Table of Contents. The higher species density is represented by the numbers 2.1 up to 6.5 species per square mile.
- c. Go to the Theme menu and select Query or use the Query button. The trick will be to construct a valid sentence that will enable you to obtain data. Since we want to select out the communities that have a species density 2.1 or higher, you need to make your Query state this.
 - d. Double click “Eo_sqmi” and then click once on greater than or equal to symbol, then double click on 2.1. Check your sentence and if satisfied, click “New Set”. If the syntax error window appears, go back and determine what you did wrong.

- e. In your View, all communities with a species density of 2.1 or higher should appear yellow. **(13) Find out the names of these communities using the identification tool, or use the Theme’s Table and the Promote Button. In your data sheet list the communities with density of 2.1 or higher.** (Data Sheet)

Hint: You can highlight the field “Town”, select the “Ascend Button” and then do a promote. All towns selected for higher species densities will now appear in alphabetical order.

- f. *(14) Also identify which trails pass through these communities, and fill in the chart on the data sheet.* (Data Sheet)



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Data Sheet

Social Studies
Mathematics
Language Arts
Science

“Long Distance State Trails —Where should we begin Maintenance?”

Name: _____ Date: _____

1. Based on your first observations which trail seems to have mostly communities with low or no species density?

2. Examine the table and find five communities that have low species density and five that have higher species density.

(Lower Density)

- a. _____
b. _____
c. _____
d. _____
e. _____

(Higher Density)

- a. _____
b. _____
c. _____
d. _____
e. _____

3. As you look at the map, try to determine by observation which trail is closest to your community and which is farthest away.

Closest: _____

Farthest: _____

4. Find the trail that is the greatest distance from the center of your community, and the trail that is the closest to the center of your community.

Greatest Distance: _____

Closest: _____

5. Using the measure tool, determine the distance in miles of the Midstate Trail from its Northern to Southern border.

Northern to Southern border: _____

6. When you reach the end, read and record the meters at the bottom of your View screen.

7. How does this agree with your measurement tool findings?

8. Based on this information, what would you say regarding the accuracy of the measurement tool, and its limitations?

9. Tell which trails seem to appear as “interstate” trails.




10. Where is the DEM office located for your community?



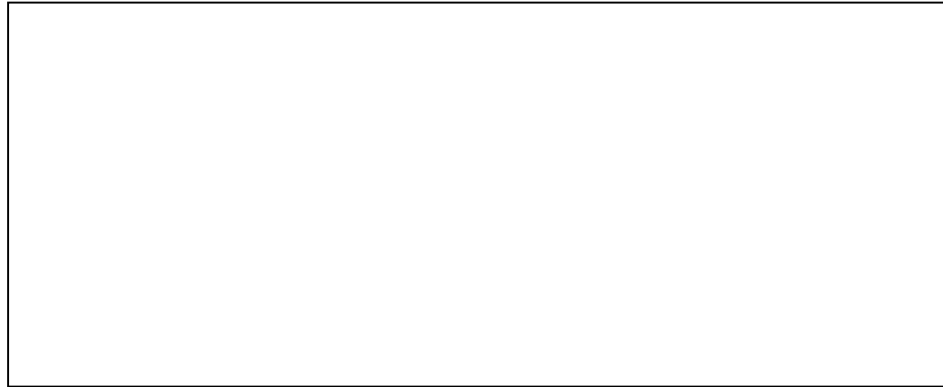
11. If the Midstate Trail was selected for maintenance work, which DEM office would need to be contacted?



12. List the communities that will need to be contacted by the Regional DEM if maintenance work is proposed on the Midstate Trail.



13. Find out the names of these communities using the identification tool, or use the Theme's Table and the Promote Button. In your data sheet list the communities with density of 2.1 or higher.



14. Also identify which trails pass through these communities, and fill in the chart on the data sheet.

Community	Name of Long Distance Trail



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DEM Question Sheet

Social Studies Mathematics Language Arts Science

“Long Distance State Trails –Where should we begin Maintenance?”

Name: _____ Date: _____

1. List the names of the long distance trails in Massachusetts.
2. In what general parts of the state are the long distance trails located?
3. In the process of maintaining the Midstate Trail, are there any areas that the trail passes through that are identified as having high species density?
4. Do any of the existing long distance trail systems in Massachusetts connect the state with other New England states?



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DEM Recommendation

Social Studies Mathematics Language Arts Science

“Long Distance State Trails —Where should we begin Maintenance?”

Name: _____ Date: _____

Using the DEM Criteria listed in the Problem, which trails would you recommend for the high school student summer maintenance/repair program, and why?